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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/911,139	07/23/2001	Ruediger Bauder	BAUDER 1-1-1	2375
27964	7590	11/30/2004	EXAMINER	
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2631

DATE MAILED: 11/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/911,139

Applicant(s)

BAUDER ET AL.

Examiner

Khanh Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 July 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11/15/2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 11/26/2004.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1, 4-6, 8-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 in view of Wessel et al. U.S. Patent 6,275,685 B1.

Regarding claim 1,

Cova invention is related to a system for linearly transmitting an amplified output signal using predistortion. Even though the transmitter is mentioned throughout the invention, figure 4 illustrates a transceiver, including a transmitter and a receiver, implemented in Cova invention. Cova does not teach that the transceiver operable in WCDMA environment as claimed in the preamble and in body of the claim. Wessel et al. discusses in Background of the invention in another US patent in that the non-linear characteristics of a linear amplifier tend to produce interaction between the signals being amplified and the amplified output will contain intermodulation products, see column 1 lines 27-43. Wessel et al. further states that as systems migrate to wider band modulation, e.g. CDMA 2000 and WCDMA, a linearisation technique is required which is fundamentally a wide band technique. Most implementations of pre-distortion are inherently wideband, see column 1, lines 62-67. Cova system differs from Wessel et al. discussion in that Cova does not disclose the system for WCDMA application. However,

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Cova teaches a system for linearly transmitting an amplified output signal using predistortion, which is inherently applied to wideband. In view of the foregoing discussion, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova system can be modified to apply to wideband such as WCDMA. The motivation is that predistortion technique is inherently wide band as discussed in Wessel et al. invention.

Figure 6 illustrates a block diagram of the predistortion system including a transmit chain having a lookup table that provides filter coefficients to a digital predistortion filter 601. Figure 6 is a more detailed functional block diagram of the predistortion system 500 depicted in figure 5, wherein the predistorter 407 is implemented with a predistortion filter 601 and a LUT 603 in figure 6. In view of that, the predistortion filter 601 corresponds to the digital predistorter as claimed in the instant application, and the LUT 603 corresponds to the claimed look up table in the transmit chain. In column 5 lines 45-60, see figure 4, Cova discloses the in-phase and quadrature component signals output by the modulator 403 are input into the predistorter 407. The predistorter 407 is operative to modify the in-phase and quadrature component signals output from the modulator 403 so as to compensate for any distortion that takes place in the power amplifier 103. In accordance with Cova invention, the predistorter uses a predistortion scheme that is not only dependent on the instantaneous power of the sample, but also on the power of the previous samples. A person of ordinary skill in the art will appreciate that the in-phase and quadrature component signals are used to calculate instantaneous power. As a result of that, the

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in-phase and quadrature component signals are power indicators, which are claimed in the instant application.

Referring to figure 4, in column 6 lines 58-67, a trainer 431, coupled to the transmission chain through the predistorter 407, receives the output signals from the digital quadrature demodulator 425 located on the receive chain of the transceiver in figure 4. The trainer 431 also receives the equivalent of the exact modulated signal (the output signals from the modulator 403) that was intended to be sent out, and the signal that was actually transmitted through the receive chain. In column 7 lines 1-7, the trainer provides one or more "trainer" signals to the predistorter to update the predistorter's response. In view of the foregoing teachings, the trainer signals are a function of the signal that was actually transmitted, or equivalently is a function of the output of the transmit chain. The trainer signals also correspond to the claimed digital compensation signal. Referring back to figure 4, because the trainer subsystem 605 also receives the output signals (in-phase and quadrature component signals) from the modulator 403, the trainer employs both in-phase and quadrature component signals, corresponding to the claimed power indicators, and trainer signals, corresponding to the digital compensation signal as recited above, to provide the inverse characteristics of the power amplifier to the LUT 603, which provides filter coefficients to the predistortion filter 601 for reducing distortion in the output as claimed in the instant applicant. Finally, the trainer in Cova invention corresponds to the claimed predistorter training circuit.

Regarding claim 4, figure 12 illustrates a functional block diagram of the trainer 431 (see also figure 5) including a solver 1201, which processes a block of the stored data to generate the complex parameters used to update the LUT of the predistorter, see column 14, lines 17-29. In view of that, the solver 1201 corresponds to the claimed coefficient update circuit, and the filter coefficient updates (see figure 12) are representative of the claimed alternative power indicators.

Regarding claim 5, as recited in claim 1, the in-phase and quadrature component signals correspond to the claimed power indicators.

Regarding claim 6, Cova does not expressly disclose the trainer operates only in a training mode. However, in column 10 lines 47-54, Cova discloses the trainer subsystem periodically receives "batches" of data containing the modulation signal samples, power amplifier input signal samples, and power amplifier signal samples. The trainer subsystem 605 provides the inverse characteristics of the power amplifier to the LUT 603. In view of the foregoing disclosure, since the trainer subsystem periodically receives "batches" of data, the trainer also operates periodically to update the predistorter. Therefore, it would have been obvious for one of ordinary skill in the art at the time in the invention was made that the trainer can be considered to operate when it is needed, or equivalently in a training mode as claimed in the instant application.

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Regarding claim 8, claim 8 and claim 1 are similar in scope. Claim 1 discloses components performing steps as set forth in claim 8. As result of that, claim 8 is rejected on the same ground as for claim 1.

Regarding claim 9, said claim is rejected on the same ground as for claim 2 because of similar scope.

Regarding claim 10, said claim is rejected on the same ground as for claim 3 because of similar scope.

Regarding claim 11, said claim is rejected on the same ground as for claim 4 because of similar scope. Furthermore, as recited in claim 1, the trainer employs both in-phase and quadrature component signals and provides trainer signals, corresponding to the claimed digital compensation signal, to generate the inverse characteristics of the power amplifier to the LUT 603, which provides updated filter coefficients to the predistortion filter 601. The updated filter coefficients are representative to the claimed alternative power indicators as claimed in the instant application.

Regarding claim 12, said claim is rejected on the same ground as for claim 5 because of similar scope.

Regarding claim 13, said claim is rejected on the same ground as for claim 6 because of similar scope.

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2. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 B1 as applied to claim 1 above, and further in view of Park et al. U.S. Patent 6,373,902 B1.

Regarding claim 2, referring back to figure 4 of Cova invention, the transmitter 400, comprising a transmit chain (the forward signal processing path) and receive chain. The transmit chain comprises an digital interpolator 409 coupled to the output of the predistorter 407, a digital-to-analog converter 412 coupled to an output of the digital interpolator 409 through a digital quadrature modulator 411, an analog up-converter 413 coupled to the output of the digital-to-analog converter 412, a power amplifier 103 coupled to the output of the analog up-converter 413. Cova does not expressly disclose the analog upconverter 413 is a quadrature modulator as claimed in the instant application. However, in column 8 lines 13-35, the analog upconverter 413 receives two local oscillator signals provided by the synthesizer 435. In view of the foregoing disclosure, it would have been obvious for one of ordinary skill in the art that the analog upconverter 413 is a quadrature modulator because of the following reasons: first, outputs from the digital quadrature modulator 411 comprise in-phase and quadrature component signals; secondly, the analog upconverter 413 receives two local oscillator signals for upconverting the in-phase and quadrature component signals as appreciated by one of ordinary skill in the art.

Cova, however, does not disclose, an analog low pass filter coupled to an output of the digital-to-analog converter as claimed in the instant application.

Park et al. discloses a very similar device for linearizing a transmitter in a digital radio communication system having a predistortion lookup table storing predistortion data determined, in advance, the distortion characteristics of the transmitter with respect to input baseband data, see column 2, lines 55-64. Figure 1 illustrates a communication system using a typical predistortion technique to compensate for distortion of transmission signal. In column, 3 lines 35-67, the system includes in the transmit chain a pre-distort RAM 21, digital to analog converters 15I and 15Q coupled to the pre-distort RAM 21, filters 25I and 25Q coupled to the D/A converters 15I and 15Q, a quadrature mixer 26 coupled to the output of filters 25I and 25Q, a power amplifiers 34. Figure 2 further shows filters 25I and 25Q being low pass filters.

Cova and Park et al. teachings clearly are in the same field of endeavor. Cova and Park et al. systems operate in similar manner. Cova teachings differ from Park et al. teachings in that Cova applies digital filtering on the base band signal in the interpolation stages. Park et al. uses analog low pass filters instead. As known in the art, low pass filtering is required in the transmit chain to remove spurious signal before the up-conversion, therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova predistortion system can be modified to add analog filters between the analog upconverter 413 and the DAC 412 as shown in Park et al.. The motivation is that low pass filtering is required at some point in the transmit chain to remove any spurious signal before the up-conversion.

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3. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 B1 as applied to claim 1 above, and further in view of Ha U.S. Patent 6,240,144 B1.

Regarding claim 3, referring to figure 4 in Cova invention, in column 8 lines 44-65, on the receive chain, the receive signal from coupler 419 is provided to an analog downconverter 423 receiving two local oscillator signals provided by the synthesizer 435. Using analogous argument as for claim 2 above, the analog downconverter 423 is a quadrature demodulator as claimed in the instant application. Figure 4 further shows an analog to digital conversion (ADC) 424 coupled to outputs of the analog downconverter 423.

Cova invention does not show a low pass filter coupled between analog downconverter 423 and ADC 424. Ha discloses a similar apparatus and method of linearizing a power amplifier in a mobile radio communication system. As shown in figure 2, in column 6 lines 40-59, the receive chain includes a quadrature demodulator 144, low pass filters (LPFs) 146 148, and ADCs 150 152.

Using similar argument as for claim 2, Cova and Ha teachings are in the same field of endeavor. Cova and Ha systems operate in similar manner. Cova teachings differ from Park et al. teachings in that Cova does not show a LPF employed between the quadrature demodulator and ADC. Ha employs LPFs 146 and 148 between the quadrature demodulator 144 and ADCs 150 152. As known in the art, low pass filtering is employed to prevent aliasing by limiting the input signal bandwidth to below half the sampling rate, for that reason, it would have been obvious for one of ordinary skill in the

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art at the time the invention was made that Cova predistortion system can be modified to add analog LPF between the analog downconverter 423 and the ADC 424 as taught in Ha invention. The motivation is that aliasing phenomenon becomes a problem in A/D conversion systems when an input signal contains frequency components above half the ADC sampling rate. The best approach to eliminate unwanted high frequency components and interference is to use a low-pass filter, which inhibits aliasing by limiting the input signal bandwidth to below half the sampling rate.

4. Claims 7 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 B1 as applied to claim 1 above, and further in view of Miyashita U.S. Patent 6,288,610.

Regarding claim 7, Cova does not disclose a root raised cosine circuit provides the power indicator as claimed in the instant application.

Miyashita discloses in another US Patent the utilization of root raised cosine filters to pulse shape digital inputs (real part signal I and imaginary-part signal Q) of an apparatus shown in figure 3 for compensating distortion in the transmit signal. First, Cova and Miyashita are in the same filed of endeavors. Pulse shaping of digital signal is known in the art, therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova can be modify to implement root raised cosine filters to perform pulse shaping on the I and Q component outputs from the digital modulator 403 as shown in figure 4 of Cova invention. The implemented root

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raised cosine filters correspond to the claimed a root raised cosine circuit providing the power indicators (I and Q component signals). The motivation is that:

- First, in column 7, line 65 through column 8 line 2, Cova expresses the interpolation stages include digital filtering for pulse shaping the base band signals;
- Second, because digital signals (e.g. 0 and 1) are represented by pulses, which are not physically realizable since the pulses have rectangular bandwidth. Pulses do not have rectangular bandwidth may introduce intersymbol interference (ISI) between adjacent pulses at the receiver. A known technique for preventing ISI is the use of pulse shaping such as a root raised cosine filter whose pulse shape characteristics is very close to rectangular.

Regarding claim 14, said claim is rejected on the same ground as for claim 7 because of similar scope.

5. Claims 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 and further in view of Park et al. U.S. Patent 6,373,902 B1 and Ha U.S. Patent 6,240,144 B1.

Regarding claim 15, referring to figure 4 of Cova invention, as recited in claim 1, Cova system can be modified to apply to wideband such as WCDMA and the motivation is stated in claim 1 in view of Wessel et al.. The transmitter 400 in figure 4 comprises:
A transmit chain including:

A digital predistorter 407, wherein the digital predistorter 407 is implemented as a predistortion filter 601 and a LUT 603. The LUT 603 provided filter coefficients to the predistortion filter 601 based on power indicators as discussed in claim 1. In view of the foregoing discussion, predistortion filter 601 is equivalent to the claimed digital predistorter, and LUT 603 corresponds to the claimed lookup table;

A digital interpolator 409 coupled to the output of the digital predistorter 407, the digital interpolator 409 corresponding to the claimed interpolator;

A digital to analog converter 412, corresponding to the claimed digital to analog converter, coupled to output of the digital interpolator 409;

Cova does not teach employing a low pass filter as set forth in the claim. However, the combination of Cova and Park et al. teachings discuss the feature thoroughly in claim 2 above. The motivation is also stated in claim 2 above;

An analog upconverter 413, equivalent to the claimed quadrature modulator as discussed in claim 2 above, coupled to the output of the low pass filter as taught by the combination of Cova and Park et al. teachings as explained in claim 2 above;

A power amplifier 103 coupled to output of the analog upconverter 413;

A receive chain including: the claimed quadrature demodulator, a low pass filter, and an analog to digital converter are rejected in claim 3 above in view of Ha U.S. Patent 6,240,144 B1. Referring to figure 4 of Cova invention, the receive chain further include a trainer, corresponding to the claimed predistorter training circuit, which is rejected in claim 1 above.

Regarding claim 16, said claim is rejected on the same ground as for claim 4 because of similar scope.

Regarding claim 17, said claim is rejected on the same ground as for claim 5 because of similar scope.

Regarding claim 18, said claim is rejected on the same ground as for claim 6 because of similar scope.

Regarding claim 19, said claim is rejected on the same ground as for claim 7 because of similar scope.

Regarding claim 20, Cova does not teach the transceiver is located within a cellular phone as claimed in the instant application. However, as discussed in claim 1, Cova system can be modified to apply to WCDMA application. Because WCDMA is a technology for wireless cellular phone, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova system can be implemented in a cellular telephone. The motivation is that cellular telephone is inherently a transceiver, and Cova teachings can be modified to use in cellular environment.

Conclusion

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6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ichihara U.S. Patent 6,587,513 discloses "Predistorter".

Jeong U.S. Patent 6,711,217 B1 discloses "Apparatus And Method For Linearized Power Amplification".

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Tran whose telephone number is 571-272-3007. The examiner can normally be reached on Monday - Friday from 08:00 AM - 05:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Thanh Cong Tran 11/26/2004

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